



Space-Time Variation of Sea Surface Temperature and Chlorophyll in the Gulf of California



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Introduction

The Gulf of California (GC) is a marginal sea located in northwestern Mexico (fig. 1). It is an evaporative basin that communicates with the North Pacific and contains a highly productive ecosystem associated with coastal upwelling events, tidal mixing, mesoscale eddies and thermal fronts. The aim of this work was to describe the change of chlorophyll concentrations in two periods.

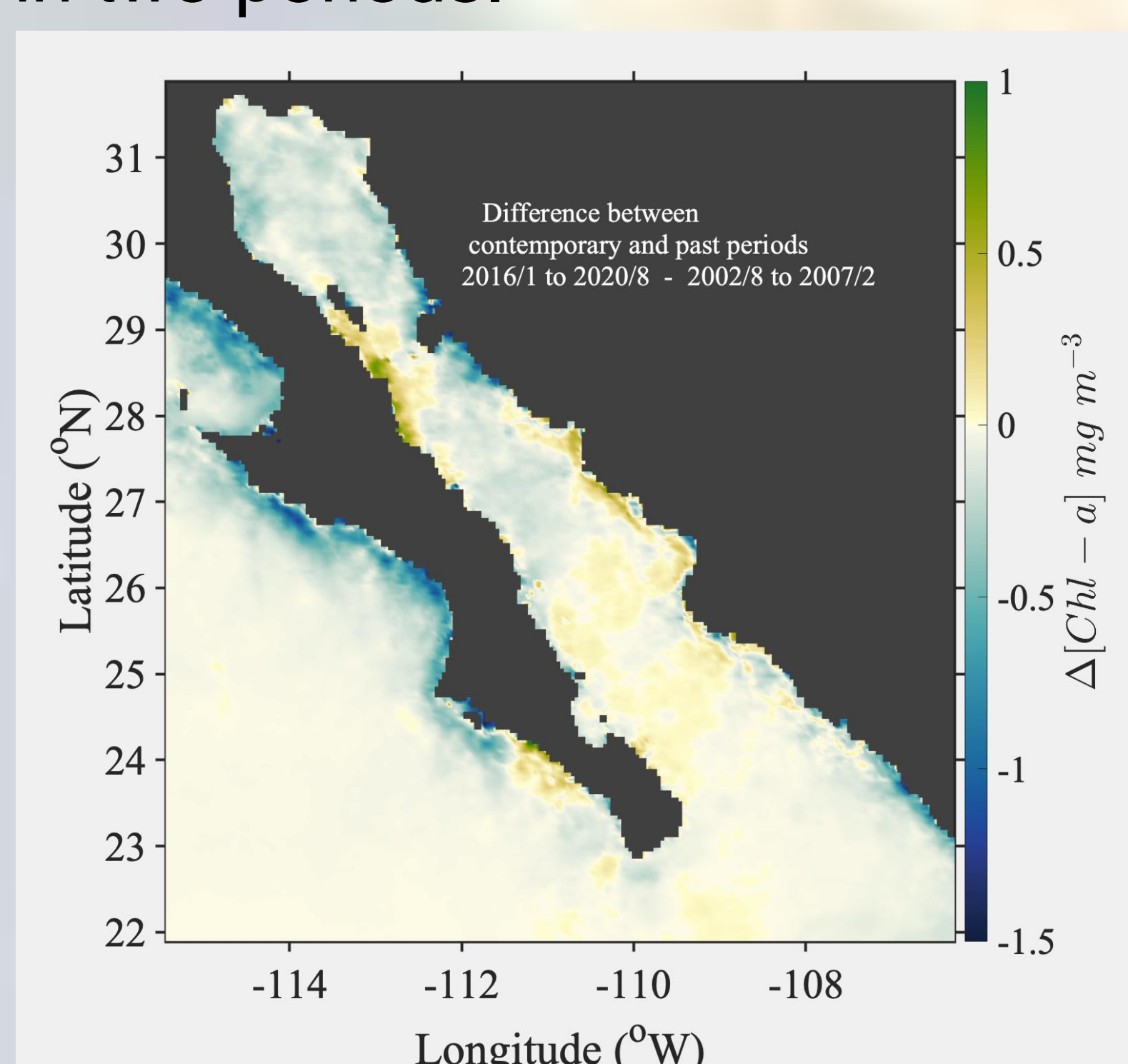


Fig. 1 Gulf of California. The increase (Δ) is the change of chlorophyll concentrations in two periods.

Methods

Sea surface temperature and chlorophyll-a satellite data were obtained for 2002 to 2020 from MODIS-Aqua. This information was used to study interannual variability, seasonal and regional trends in the GC. Average chlorophyll concentration differences were obtained for two periods: 2002/8 to 2007/2 and 2016/01 to 2020/8; 2007/03 to 2015/12 was discarded because ENSO events swarm and mask trends of chlorophyll concentrations. Two seasons were considered for the analysis: winter (December to May) and summer (July to October); June and November were considered transitional months.

Results and Discussion

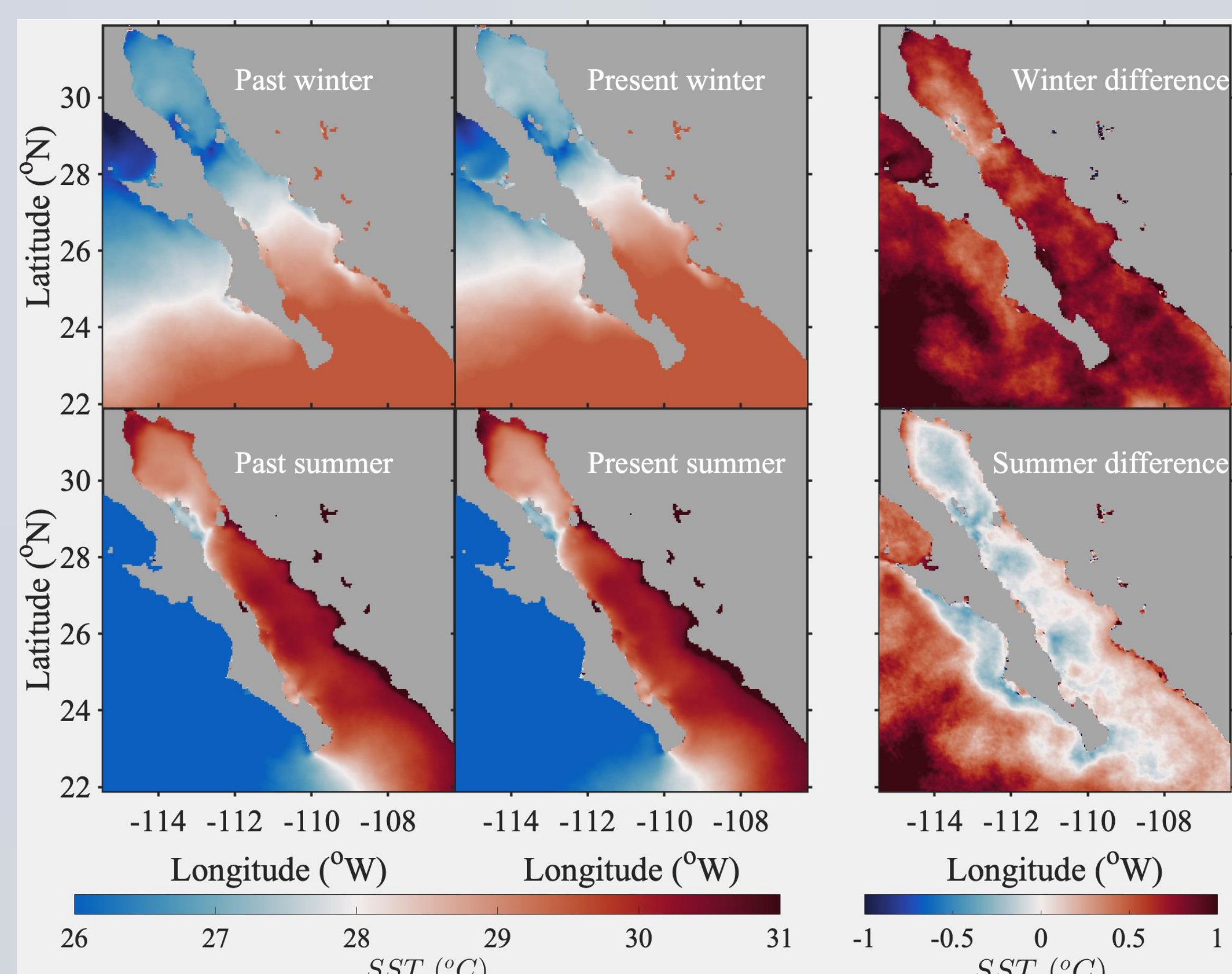


Fig. 2. Sea Surface temperature and their difference in the two periods.

Temperature showed a clear seasonal increase between periods (fig. 2). Difference in chlorophyll resulted in regions with varying trends over time (fig. 3). Positive values indicate increase in chlorophyll concentration and temperature, and *vice versa*.

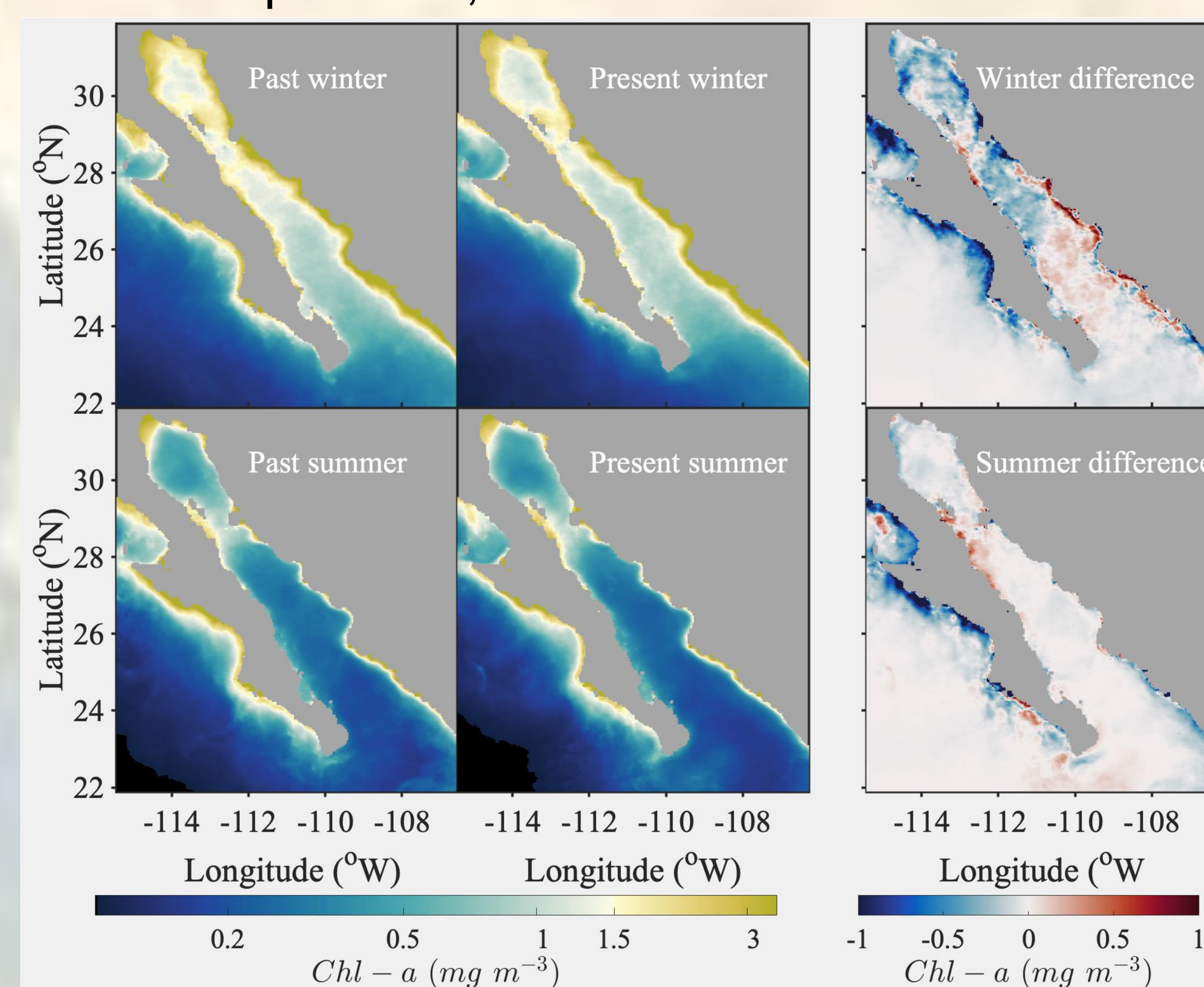


Fig. 3. Chlorophyll concentrations and their difference between two periods.

Based on the differences, geographic polygons (fig. 4) were delimited and the time series of several variables by region (not shown here) were obtained for 2002 to 2020. Time series were constructed from the monthly series of satellite images of all the variables to correlate chlorophyll concentrations with the other variables.

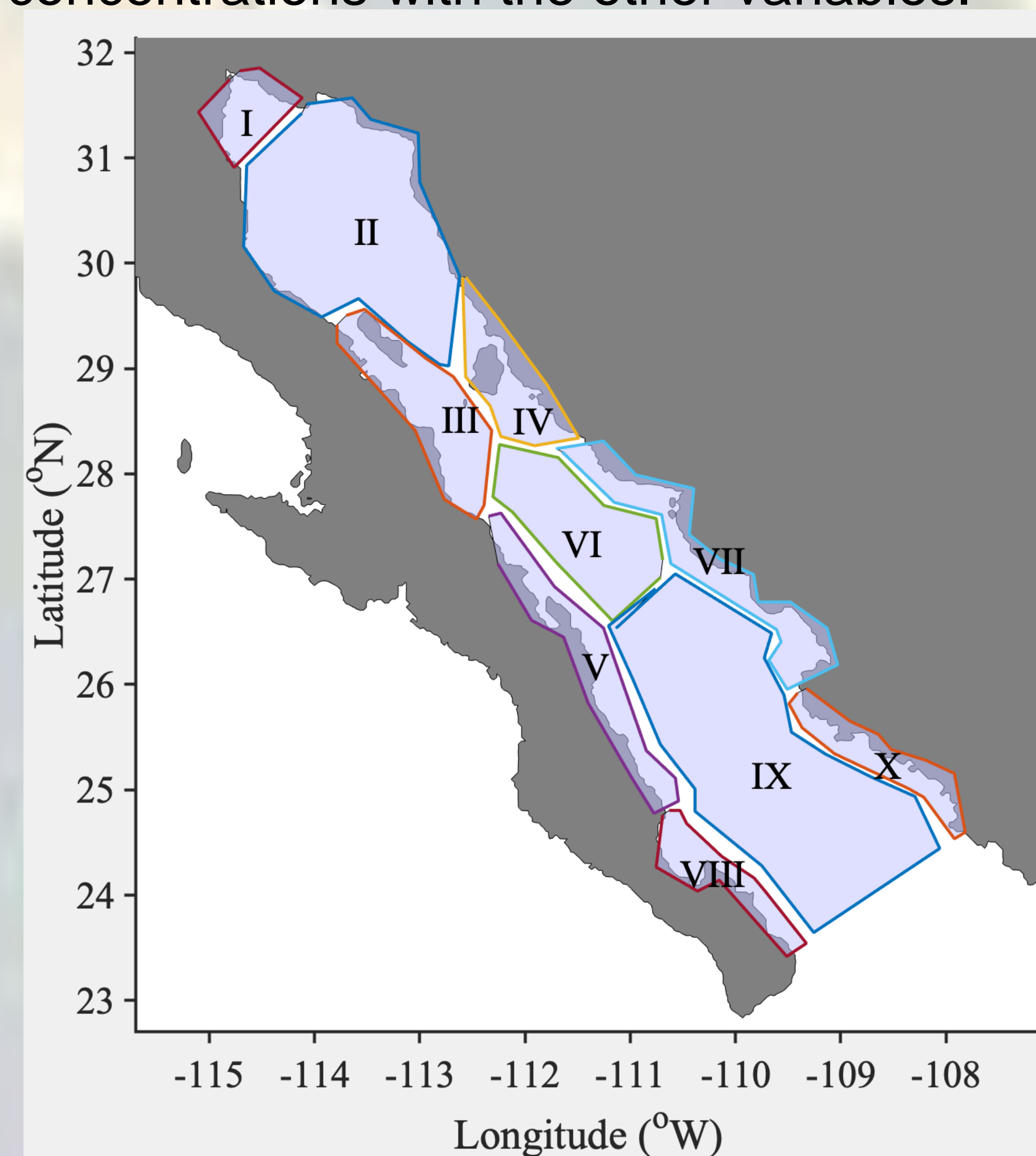


Fig. 4. Regions in the Gulf of California based on differences in chlorophyll concentration.

A time series analysis of several satellite-measured variables shows a change of regime starting in 2012 up to 2020. This analysis of regional trends can be used as the basis for a novel regionalization of the CG, for example in a climate change scenario affecting fisheries or biodiversity distribution.

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